

Importance of Intermodal Connectivity and Bottleneck Elimination

Dr. Barry E. Prentice

Director

Transport Institute, Asper School of Business

University of Manitoba

Intermodal Supply Chain Networks

Intermodal transport refers to the shipment of goods that involves two, or more, modes of transport in a single journey.

Ideally, each mode of transport is used for the length of haul that minimizes the line haul cost for the maximum distance moved.

The best attributes of each model of transport are combined in a system that yields the lowest cost of transportation for the supply chain.

Rationale for Intermodal Transport

- Trade-off between time and cost: a rail-barge intermodal system should be lower cost than all rail, but will be slower
- Accessibility: trucks are usually needed for pick-up and delivery, but don't do well on ocean crossings

Intermodal Freight Bottlenecks

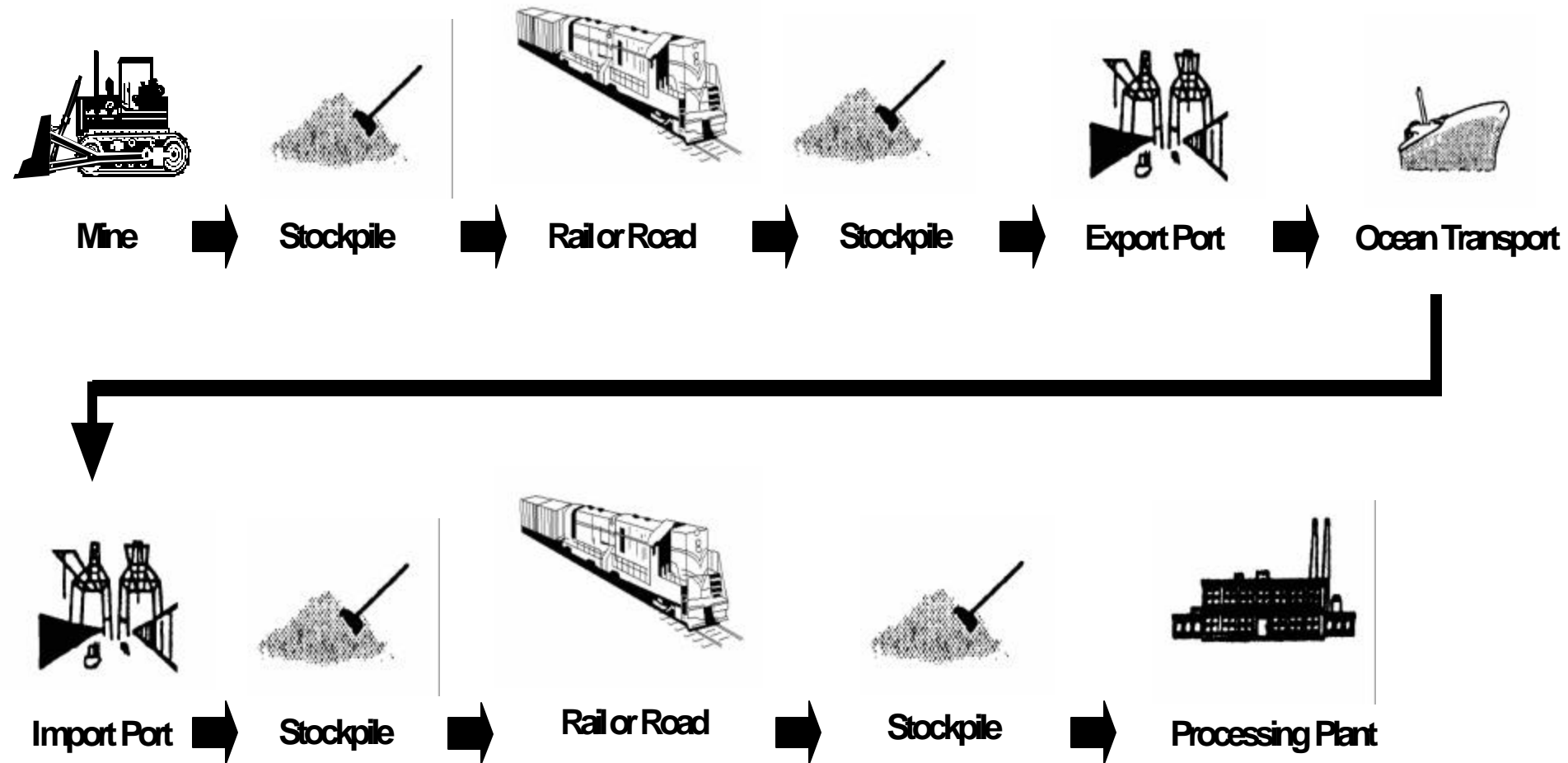
- Definition
 - Any impediment that slows or halts the flow of traffic.
- Symptoms
 - Congestion slowdowns, queue formation, shipping delays
- Causes
 - physical, economic, political and environmental

Bottleneck Elimination

- Cascading Bottlenecks
 - The impact of any bottleneck can accentuate other bottlenecks, and create new ones
- “Bottleneck Removal Futility”
 - *Clearing up a single bottleneck only causes another bottleneck to appear* – Manheim, 1979

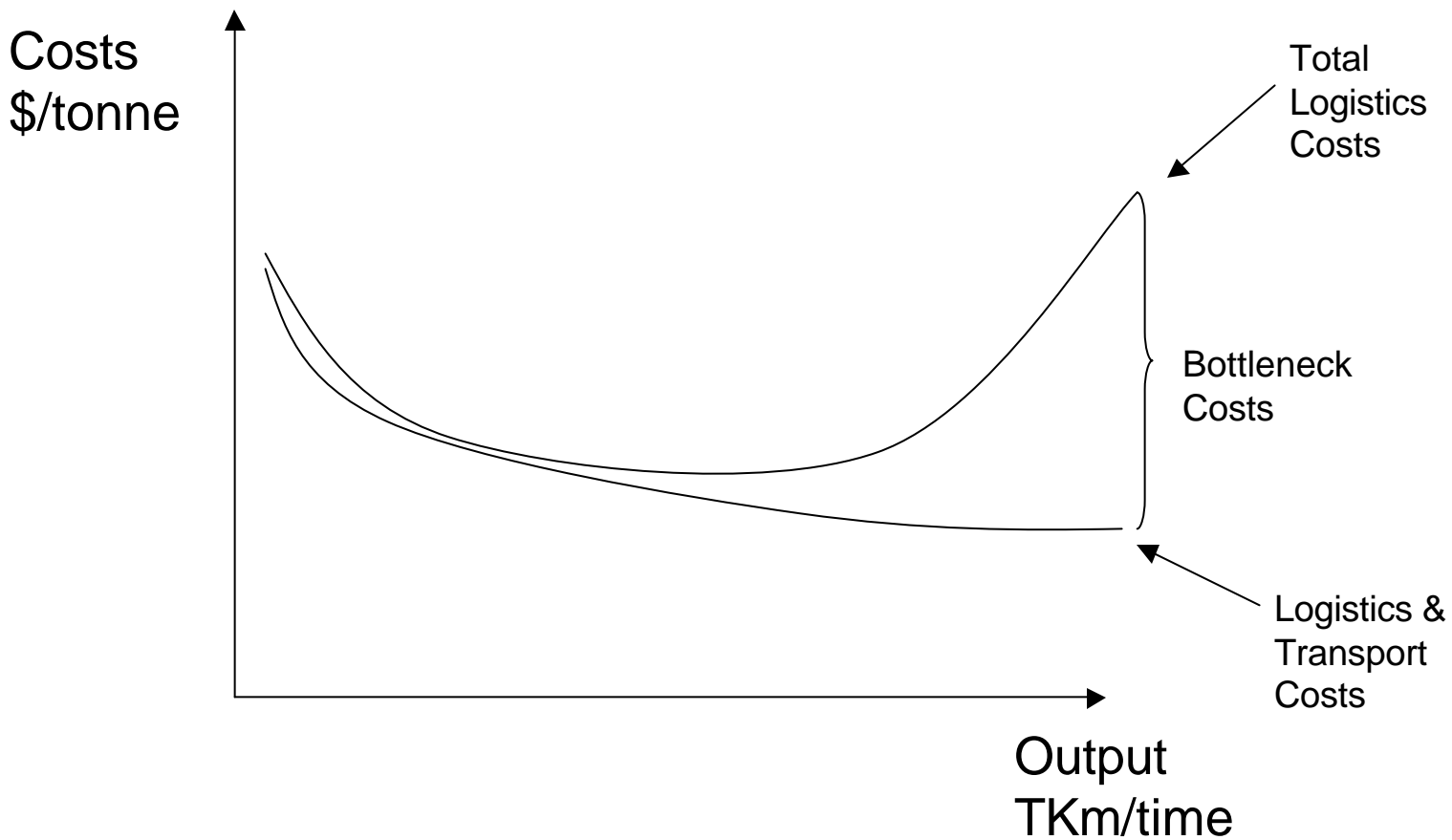
Importance of Eliminating Bottlenecks from Intermodal Transport

- The effectiveness of a supply chain network is a like the strength of materials. The fewer the cracks, the stronger the material.
- As bottlenecks are reduced or removed, the average velocity of the traffic increases. As a result, costs fall and the supply chain network becomes more competitive.

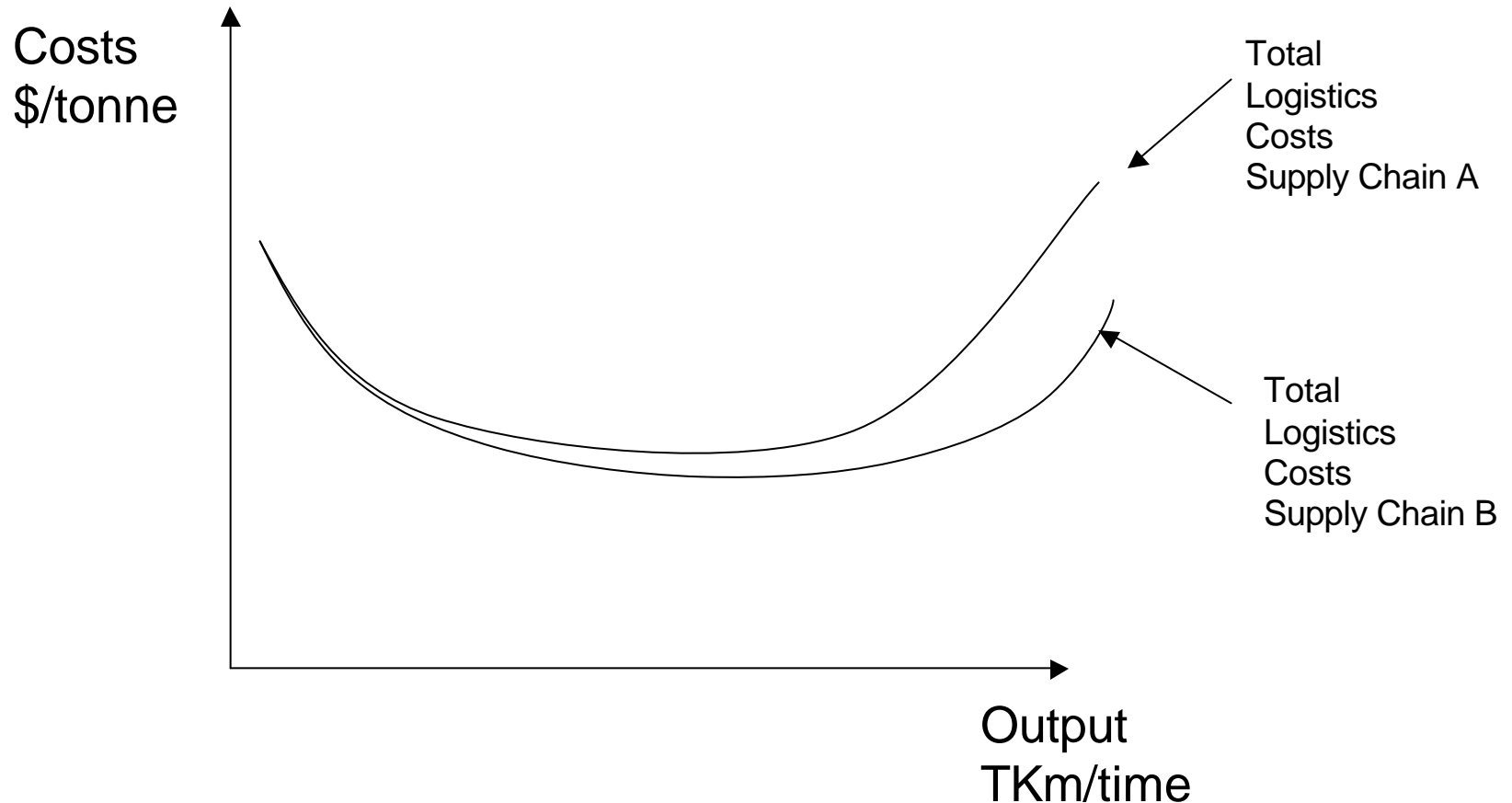


Typical bulk supply chain for single point product supply

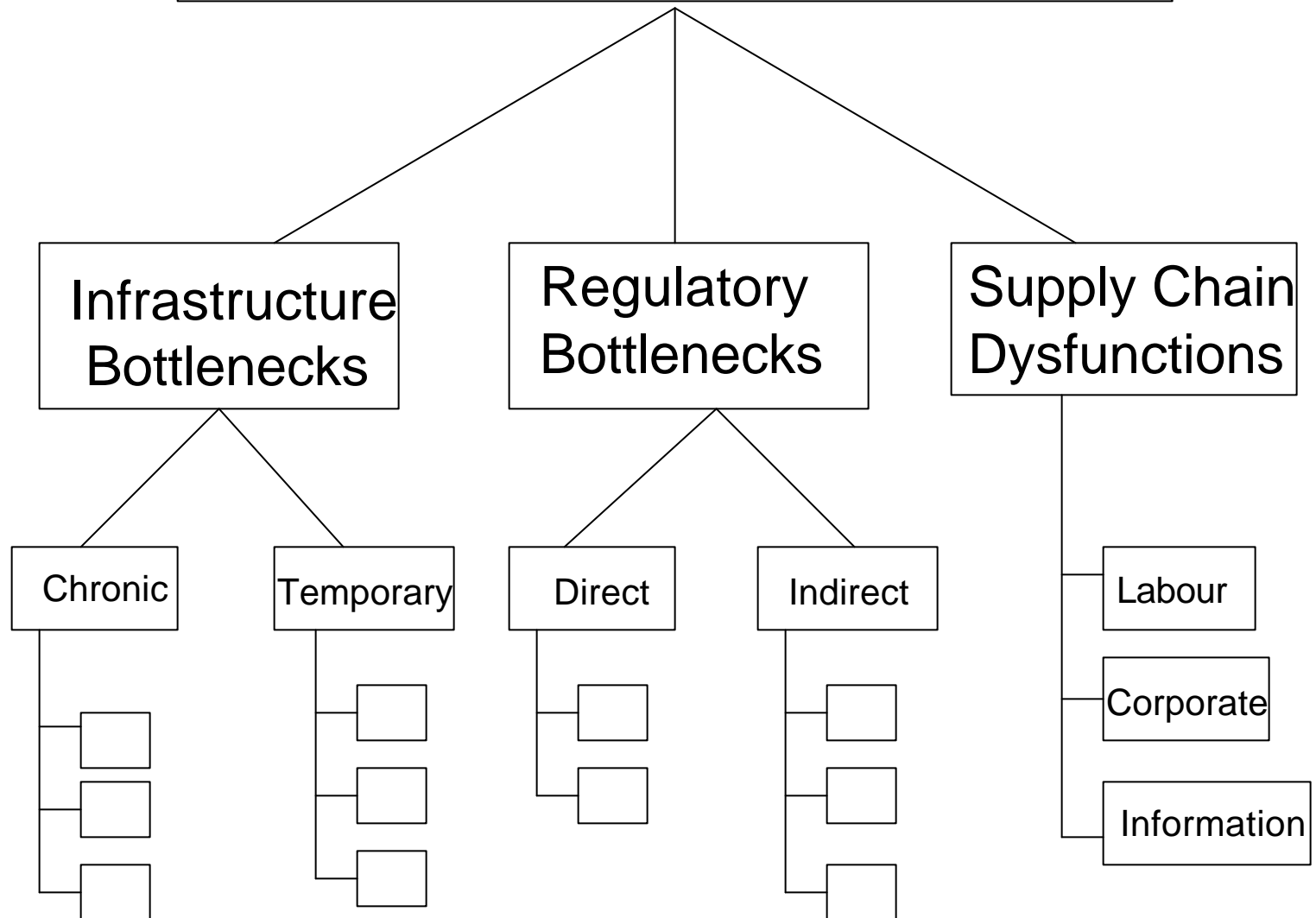
Economic Model of Supply Chain Network Costs



Competing Supply Chain Intermodal Networks



Taxonomy of Bottleneck Causes



Any infrastructure bottleneck can be relieved, at least temporarily, if enough money and time is invested

Infrastructure Bottlenecks

```
graph TD; A[Infrastructure Bottlenecks] --> B[Chronic Constraints]; A --> C[Temporary Constraints]; B --> D[Climate Barriers]; B --> E[Physical Restrictions]; B --> F[Under-Investment]; C --> G[Weather Disruptions]; C --> H[Market Perturbations]; C --> I[Construction, Accidents, etc];
```

Chronic Constraints

Climate Barriers

Physical Restrictions

Under-Investment

Temporary Constraints

Weather Disruptions

Market Perturbations

Construction, Accidents, etc

Regulatory Bottlenecks

```
graph TD; A[Regulatory Bottlenecks] --> B[Direct Effects]; A --> C[Indirect Effects]; B --> D[Safety/Quality Inspections]; B --> E[Security Measures]; C --> F[Cabotage Restrictions]; C --> G[Pricing Policies]; C --> H[Competition Policy];
```

Direct Effects

Safety/Quality
Inspections

Security
Measures

Indirect Effects

Cabotage
Restrictions

Pricing
Policies

Competition
Policy

Dysfunctional Supply Chain Bottlenecks

```
graph TD; A[Dysfunctional Supply Chain Bottlenecks] --- B[Labour Work Rules]; A --- C[Competing Corporate Agendas]; A --- D[Information Incompatibility];
```

Labour
Work Rules

Competing
Corporate Agendas

Information
Incompatibility

The Basic Canadian Bulk Grain Handling and Transportation System



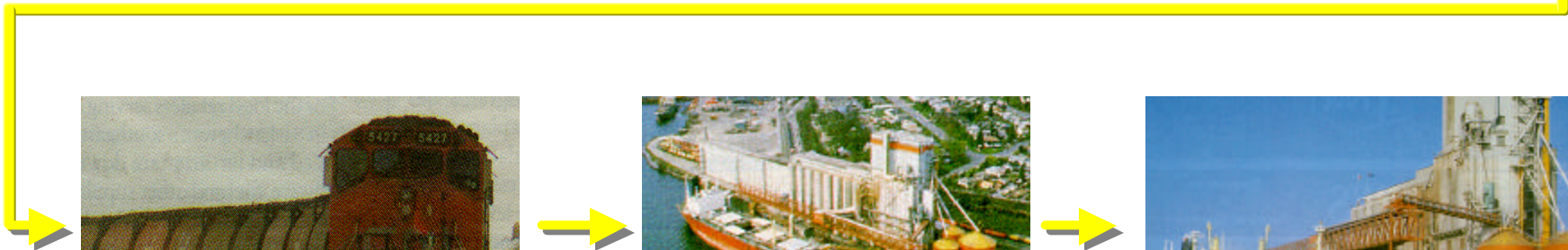
Farm Storage



*Farm to
Primary Elevators*



Primary Elevators



Unit Train



Terminal Elevators



Terminal to Vessel

The Proposed Canadian Containerized Grain Handling and Transportation System



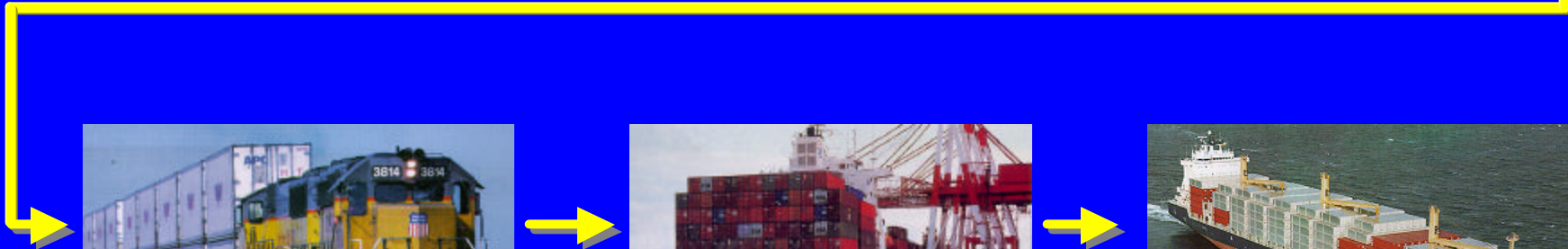
Container Loading



Truck to Inland Terminal



Ag. Container Yard



Scheduled Intermodal Train



Rail to Vessel



Scheduled Sailing

Competing Intermodal Systems for Grain Transportation

- Bulk Handling
 - Economies of size
 - Zero Tare Weight
 - Specialized material handling systems
 - Large pipeline inventories
 - Bottlenecks?
- ISO Container Handling
 - Economies of scope
 - Identity preservation
 - Minimal product handling
 - Just-in-time delivery capability
 - Bottlenecks?

Sources of Intermodal Grain Transportation Bottlenecks

Advantage
Containers

Advantage
Bulk

Infrastructure: Chronic - Climate Barriers



Physical Restrictions



Under Investment



Temporary - Weather Disruptions



Market Perturbations



Accidents, Construction, etc.



Regulations: Direct - Cabotage Restrictions



Pricing Policies



Competition Policy



Indirect - Safety/Quality Inspections



Security



Supply Chain Dysfunction: Labour Work Rules



Corporate Agendas



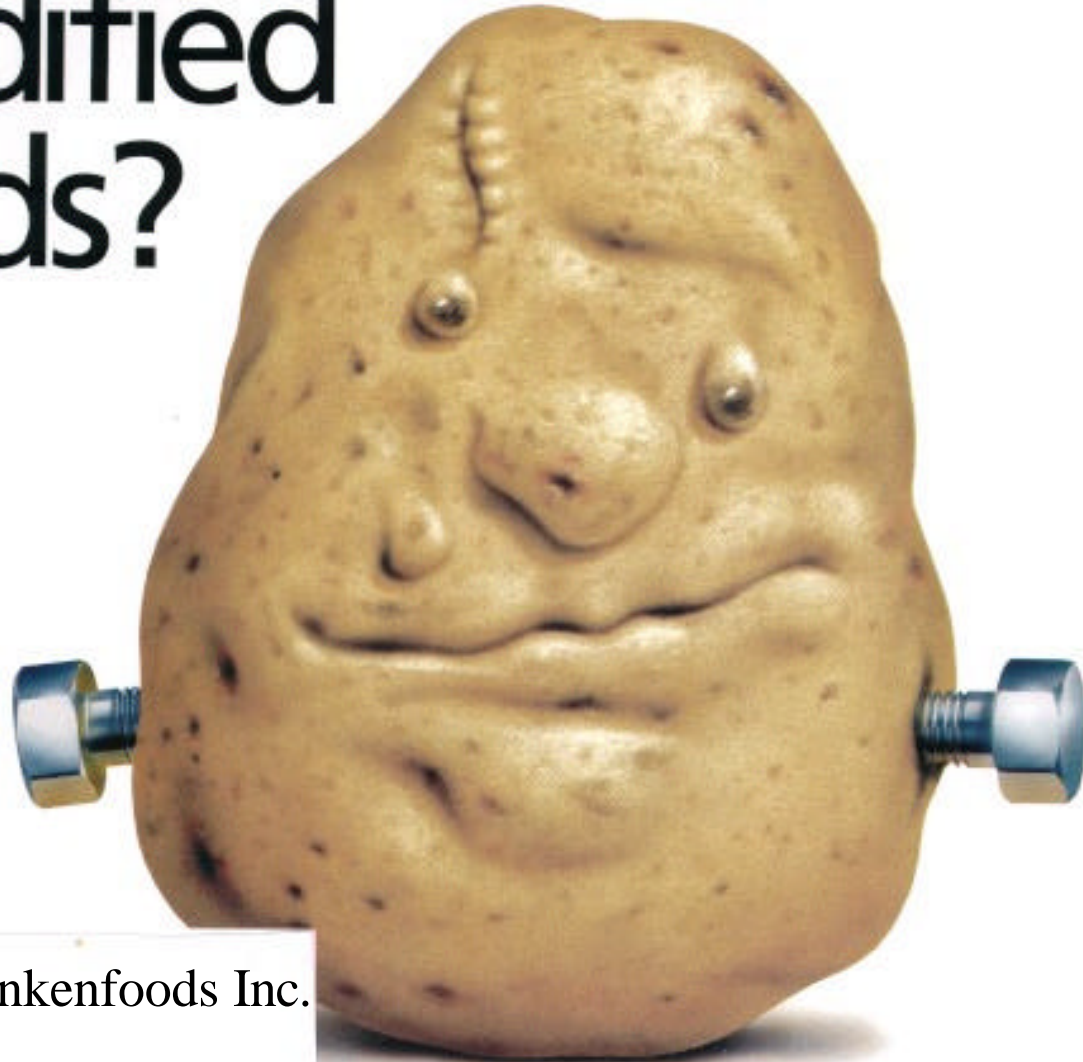
Information Incompatibility



Bottleneck Scorecard

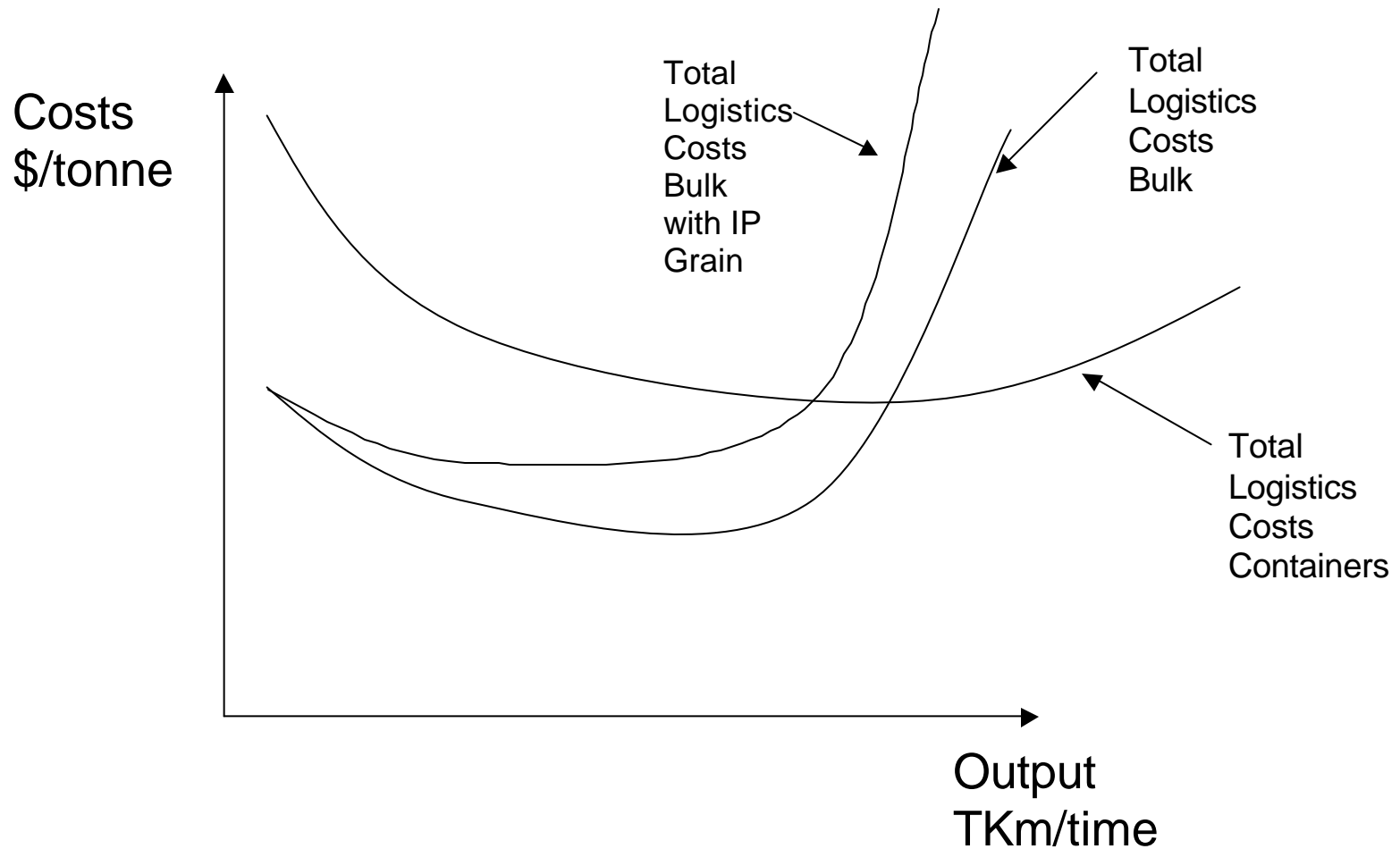
| | Chronic and Temporary Infrastructure Bottlenecks | Direct and Indirect Regulatory Bottlenecks | Dysfunctional Supply Chain's Bottlenecks |
|-------------------|---|---|---|
| Bulk Handling | Advantage Chronic | Advantage Indirect Effects | |
| ISO Containers | Advantage Temporary | Advantage Direct Effects | Advantage Corporate Policy & Information |

Who's afraid of genetically modified foods?



Courtesy of Frankenfoods Inc.

Grain Supply Chains Containers versus Bulk



Pending Bottleneck: Harvest Transportation

- Consolidation Trends:
 - Fewer, larger farms
 - Fewer, larger grain elevators
 - Fewer, larger combines
- Longer hauling distances from fields to storage could increase harvest equipment idle-time
 - More trucks
 - More portable temporary storage

Conclusions

- Removal of any bottleneck is likely to improve the efficiency of an intermodal supply chain.
- Just because a bottleneck exists, its removal may not be justified economically.
- Some parties may benefit from bottlenecks.
- Bottlenecks are a symptom of a problem, and should not be treated as the problem.